INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Design Memorandum No. 11-23
Technical Advisory

October 31, 2011

TO: **All Design, Operations, and District Personnel, and Consultants**

FROM: ***/s/ Alfredo B. Hanza***
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Highway Design and Technical Support Division

SUBJECT: **Traffic-Signal Cantilever Structure**

REVISES: ***Indiana Design Manual*** **Section 77-4.03**

ADDS: ***Indiana Design Manual*** **Section 77-4.04**

SUPERSEDES: **Design Memorandum 11-20 Technical Advisory**

EFFECTIVE: **January 11, 2012, Letting**

A signal-cantilever structure is designed to satisfy the AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, 2009, Fifth Edition.

A signal-cantilever structure and its foundations should be as shown on Recurring Plan Detail 805-T-177d. See section I below for guidance in selecting a standardized structure for use. See section II below for design criteria for a non-standardized structure.

I. Selection Guidance

Recurring Plan Detail 805-T-177d shows details for standardized signal-cantilever structures, pole section 2, combination arm, and drilled-shaft and spread foundations.

If soil-borings information is available for a roadwork project that the signalized intersection is part of, it should be used to determine if soil is cohesive or sand, the soil-bearing capacity, and the friction coefficient. Otherwise, the designer should contact the Office of Geotechical Services. If soil-properties information is unavailable, one boring should be made at the intersection to be signalized. Once the soil properties are known, and the values are equal to or higher than those shown in Figure 11-23A, the foundation type can be determined as shown in the Figure.

Foundation Type	Soil Properties	Support	Arm Length, L, ft
A	Cohesive, Q_u = 750 lb/ft; or Sand, Friction Angle = 30 deg. Allow. Bearing Capacity = 1200 psf, and Coeff. of Friction = 0.3	Drilled Shaft	≤ 35
B		Drilled Shaft	$35 < L \leq 60$
C	Cohesive, Q_u = 750 lb/ft; or Sand, Friction Angle = 30 deg Allow. Bearing Capacity = 1200 psf, and Coeff. of Friction = 0.3	Spread Footing	≤ 35
D		Spread Footing	$35 < L \leq 60$

SIGNAL-CANTILEVER-STRUCTURE FOUNDATION-TYPE DETERMINATION

Figure 11-23A

If the soil properties are such that the values are lower than those shown in Figure 11-23A, the foundation should be designed, and its details should be shown on the plans.

A signal-cantilever structure should be designed to provide a minimum clearance of 17.5 ft under each signal head or sign. Clearance should be the vertical distance from the lowest point of the signal head or sign to a horizontal plane to the pavement surface below the signal head or sign.

A three-section signal head may be placed where a five-section signal head is shown on Recurring Plan Detail 805-T-177d.

The structure should be provided with vibration-mitigation devices if either of the conditions applies as follows:

1. structure with arm length in excess of 50 ft; or

2. structure is located where the speed limit exceeds 35 mph and the ADT exceeds 10,000, or the ADTT exceeds 1000. ADT and ADTT are for one direction regardless of the number of lanes.

The foundation location and type, pole height, arm length, and sign designations and messages should be shown on the plans. The true arm length should be shown from the center of the pole to the end of the arm. Such length, for pay-item-determination purposes, should be rounded to the higher 5-ft increment. The plans should show ADT and ADTT for each direction.

II. Design Criteria

If a structure shown on Recurring Plan Detail 805-T-177d cannot be used, its foundation, pole, arm, and connections should be designed utilizing the design conditions as follows:

1. wind speed of 90mph;
2. service life of 50 yr;
3. fatigue Category II;
4. galloping considered;
5. truck gusts considered with truck speed of 60 mph;
6. backplates included for signal heads; and
7. C_d for structure members = 1.1 for fatigue and in accordance with AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals*, Table 3-6 for working loads.

A signal cantilever structure should be designed for weights equal to or less than those shown in Figure 11-23B.

Device	Area, ft^2	Weight, lb
Signal Head with Backplate, 3 Sec., Lens Dia. 12 in.	8.7	35
Signal Head with Backplate, 5 Sec., Lens Dia. 12 in.	13.1	55
Regulatory Sign, 36 in. x 30 in.	7.5	19
Street-Name Sign, 18 in. x 96 in.	12	30
Street-Name Sign, 18 in. x 132 in.	16.5	41
Mounted Camera	1	20
Top-Pole Luminaire	2.4	53

AREA AND WEIGHT OF DEVICE
TO BE MOUNTED ON SIGNAL CANTILEVER

Figure 11-23B

If necessary, the combination arm can be added by including pole section 2, diameter of either 17 in. or 24 in., also designed for weights equal to or less than those shown in Figure 11-23B.

Where used, the combination-arm length should be equal to or less that the length of the signal-cantilever arm.

The pole's maximum allowable horizontal deflection should be limited to 2.5% of the structure height in accordance with AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals*, Section 10.4.2, group 1 load combination.

III. Pay Items

The pay items for signal cantilever structure, mast arm, have been obsoleted.

The new code numbers and pay items are as follows:

805-11373 Signal Cantilever Structure, Signal Arm 15 ft
805-11374 Signal Cantilever Structure, Signal Arm 20 ft
805-11375 Signal Cantilever Structure, Signal Arm 25 ft
805-11376 Signal Cantilever Structure, Signal Arm 30 ft
805-11377 Signal Cantilever Structure, Signal Arm 35 ft
805-11378 Signal Cantilever Structure, Signal Arm 40 ft
805-11379 Signal Cantilever Structure, Signal Arm 45 ft
805-11380 Signal Cantilever Structure, Signal Arm 50 ft
805-11381 Signal Cantilever Structure, Signal Arm 55 ft
805-11382 Signal Cantilever Structure, Signal Arm 60 ft

805-11430 Signal Cantilever Structure, Pole Section 2, Pole Dia. 17 in.
805-11431 Signal Cantilever Structure, Pole Section 2, Pole Dia. 24 in.

805-11433 Signal Cantilever Structure, Combination Arm 15 ft
805-11434 Signal Cantilever Structure, Combination Arm 20 ft
805-11435 Signal Cantilever Structure, Combination Arm 25 ft
805-11436 Signal Cantilever Structure, Combination Arm 30 ft
805-11437 Signal Cantilever Structure, Combination Arm 35 ft
805-11438 Signal Cantilever Structure, Combination Arm 40 ft
805-11439 Signal Cantilever Structure, Combination Arm 45 ft
805-11440 Signal Cantilever Structure, Combination Arm 50 ft
805-11441 Signal Cantilever Structure, Combination Arm 55 ft
805-11442 Signal Cantilever Structure, Combination Arm 60 ft

805-11383 Signal Cantilever Structure, Drilled Shaft Foundation, A
805-11384 Signal Cantilever Structure, Drilled Shaft Foundation, B
805-11387 Signal Cantilever Structure, Spread Footing Foundation, C

805-11388 Signal Cantilever Structure, Spread Footing Foundation, D

The pay unit for all items is each.

IV. Recurring Plan Detail and Recurring Special Provisions

Recurring Plan Detail 805-T-177d should be called for, along with Recurring Special Provisions 805-T-169 and 922-T-168, if one or more of the pay items listed above is required. The recurring documents appear on the Department website, at http://www.in.gov/dot/div/contracts/standards/rsp/sep11/sec800.htm.

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